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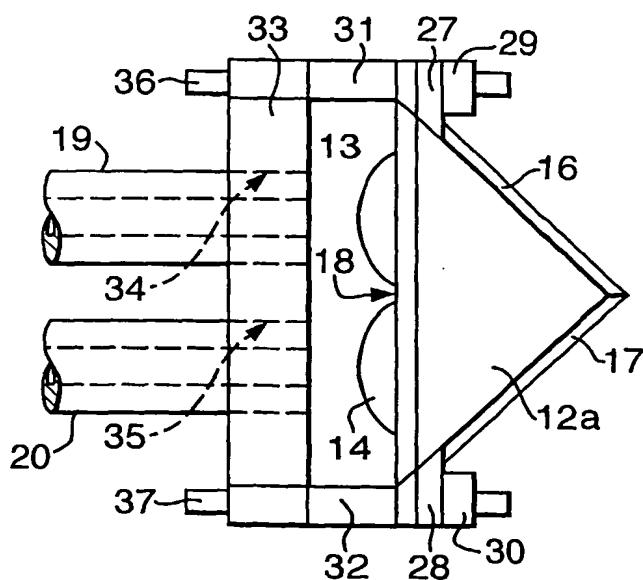
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Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv)) for US only

[Continued on next page]

(54) Title: A CONNECTOR DEVICE FOR COUPLING OPTICAL FIBRES, AND METHOD OF PRODUCTION THEREOF



(57) Abstract: A connector device for coupling non-aligned optical fibres (19, 20), in which light is directed from one fibre to another by a reflector (12) and lenses (13, 14) and the positional relationship between the ends of the optical fibres and the reflector is determined by means (31, 32, 33) for locating the end of each optical fibre to be coupled in a predetermined position both parallel to and transverse the length of the fibre. Also covers a connector device for optically coupling an optical fibre (101, Fig.14) to deliver light to or receive light from another optical component (102) by way of a lens (110), in which the positional relationship between the end of the optical fibre and the said other optical component is determined by means (106) for locating the end of the said optical fibre in a predetermined position both parallel to and transverse the length of the fibre with respect to the said optical component.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB2004/001802

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G02B6/32 G02B6/42

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G02B B29D B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|--|--|
| X | US 4 540 246 A (FANTONE STEPHEN D) 10 September 1985 (1985-09-10) | 1-3, 5, 7, 11, 14, 17, 30, 31, 34, 36-39 |
| Y | abstract; figures 1, 2, 5-10 column 2, line 14 - line 17 | 32, 33, 35, 40 |
| X | US 5 682 449 A (TAIRA-GRIFFIN LAURIE KEIKO) 28 October 1997 (1997-10-28) column 1, line 52 - line 62; figure 1 | 1, 2, 4, 5, 7, 8, 10, 12, 13, 29, 30, 36, 39 |
| | | -/- |

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
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- *X* document of particular relevance; the claimed Invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed Invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

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| Date of the actual completion of the international search 14 February 2005 | Date of mailing of the international search report 11.03.2005 |
| Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016 | Authorized officer Beutter, M |

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Inte...al Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|--|--|
| X | US 5 225 942 A (IKENO HIDEKI ET AL) 6 July 1993 (1993-07-06) figure 1 | 1,2,8,9, 30,36,39 |
| X | EP 1 146 367 A (BERG ELECTRONICS MFG) 17 October 2001 (2001-10-17) figures 1-4 | 1,2,15, 19,29, 30,36,39 |
| X | US 2003/019838 A1 (SHAW KEVIN A ET AL) 30 January 2003 (2003-01-30) | 16,19, 41,42, 45,46 |
| A | figures 1-11,18-24 | 31,34 |
| X | EP 0 450 560 A (SUMITOMO ELECTRIC INDUSTRIES) 9 October 1991 (1991-10-09) figures 10,11,20,21 | 41,42, 45,46 |
| A | 3,5 | |
| A | US 6 470 114 B1 (KLOTH AXEL K) 22 October 2002 (2002-10-22) the whole document | 5,9,12, 15,19, 31,37,40 |
| Y | US 5 346 583 A (BASAVANHALLY NAGESH R) 13 September 1994 (1994-09-13) figure 4 | 32,33,40 |
| Y | US 2002/054737 A1 (JIAN BENJAMIN B) 9 May 2002 (2002-05-09) figure 1 | 35 |
| X | DE 198 32 830 A (HEWLETT PACKARD CO) 29 April 1999 (1999-04-29) figures 4-7 | 1,4 |
| X | DE 196 52 463 A1 (FRIEDRICH-SCHILLER-UNIVERSITAET JENA, 07743 JENA, DE) 18 June 1998 (1998-06-18) the whole document | 20,21, 23-25, 27,28,47 22,26,48 |
| Y | KUFNER M ET AL: "Microlenses in PMMA with high relative aperture: a parameter study" PURE AND APPLIED OPTICS UK, vol. 2, no. 1, 1993, pages 9-19, XP002317582 ISSN: 0963-9659 the whole document | 22,26,48 |
| | -/- | |

INTERNATIONAL SEARCH REPORT

Int'l Application No
PCT/GB2004/001802

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|--|-----------------------|
| A | BECKER E W ET AL: "FABRICATION OF MICROSTRUCTURES WITH HIGH ASPECT RATIOS AND GREAT STRUCTURAL HEIGHTS BY SYNCHROTRON RADIATION LITHOGRAPHY, GALVANOFORMING, AND PLASTIC MOULDING (LIGA PROCESS)" MICROELECTRONIC ENGINEERING, ELSEVIER PUBLISHERS BV., AMSTERDAM, NL, vol. 4, no. 1, 1 May 1986 (1986-05-01), pages 35-56, XP000051563 ISSN: 0167-9317 the whole document ----- | 20, 47 |

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2004/001802

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB2004/001802

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-19,29-46

A connector device for coupling an optical fibre to another optical component and a method of producing such a connector device.

2. claims: 20-28,47,48

A method of producing a component of a connector device.

INTERNATIONAL SEARCH REPORT

Information on patent family members

| | |
|-------------------|----------------|
| Int'l | Application No |
| PCT/GB2004/001802 | |

| Patent document cited in search report | Publication date | Patent family member(s) | | | Publication date |
|--|------------------|-------------------------|---------------|--|------------------|
| US 4540246 | A 10-09-1985 | CA | 1247410 A1 | | 27-12-1988 |
| | | DE | 3484111 D1 | | 28-03-1991 |
| | | EP | 0121369 A2 | | 10-10-1984 |
| | | JP | 1797634 C | | 28-10-1993 |
| | | JP | 5007684 B | | 29-01-1993 |
| | | JP | 59184314 A | | 19-10-1984 |
| US 5682449 | A 28-10-1997 | NONE | | | |
| US 5225942 | A 06-07-1993 | JP | 4269701 A | | 25-09-1992 |
| EP 1146367 | A 17-10-2001 | US | 6422761 B1 | | 23-07-2002 |
| | | CA | 2339502 A1 | | 06-09-2001 |
| | | EP | 1146367 A2 | | 17-10-2001 |
| | | JP | 2001296449 A | | 26-10-2001 |
| US 2003019838 | A1 30-01-2003 | US | 6456766 B1 | | 24-09-2002 |
| EP 0450560 | A 09-10-1991 | JP | 3286574 A | | 17-12-1991 |
| | | JP | 3286575 A | | 17-12-1991 |
| | | JP | 3286576 A | | 17-12-1991 |
| | | JP | 3288478 A | | 18-12-1991 |
| | | JP | 3288479 A | | 18-12-1991 |
| | | JP | 3288480 A | | 18-12-1991 |
| | | JP | 4125979 A | | 27-04-1992 |
| | | DE | 69129817 D1 | | 27-08-1998 |
| | | DE | 69129817 T2 | | 07-01-1999 |
| | | EP | 0450560 A2 | | 09-10-1991 |
| | | US | 5175783 A | | 29-12-1992 |
| US 6470114 | B1 22-10-2002 | NONE | | | |
| US 5346583 | A 13-09-1994 | EP | 0642042 A1 | | 08-03-1995 |
| | | JP | 7151935 A | | 16-06-1995 |
| US 2002054737 | A1 09-05-2002 | US | 6328482 B1 | | 11-12-2001 |
| | | US | 2003002809 A1 | | 02-01-2003 |
| DE 19832830 | A 29-04-1999 | DE | 19832830 A1 | | 29-04-1999 |
| | | GB | 2330425 A | | 21-04-1999 |
| | | JP | 11174265 A | | 02-07-1999 |
| DE 19652463 | A1 18-06-1998 | NONE | | | |